Crown-Indigenous Relations and Northern Affairs Canada
Relations Couronne-Autochtones et Affaires du Nord Canada

Water Resources Division
Nunavut Regional Office
Iqaluit, NU X0A 0H0

December 6, 2019

Richard Dwyer
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CIDM # 1269396

Re: 2AM-LUP1520 – Review of documentation from Lupin Mines Inc. (LMI) in response to commitments made at the technical meeting – Lupin Mine Property – Kitikmeot Region, Nunavut

Thanks for the opportunity for Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) to review the documentation provided by LMI in response to commitments made during the technical meeting on June, 2019 with respect to Type A water licence 2AM-LUP1520.

CIRNAC comments are provided pursuant to its mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Crown-Indigenous Relation and Northern Affairs Act*.

If you have any questions or require further information with respect to this matter, contact Godwin Okonkwo at (867) 975-4550 or by email at godwin.okonkwo@canada.ca, or Ian Parsons at (867) 222-9278 or ian.parsons@canada.ca.

Sincerely,

Original signed by

Ian Parsons
Regional Coordinator, Water Resources Division

Memorandum

To: Richard Dwyer, Manager of Licensing, NWB

From: Ian Parsons, Regional Coordinator, Water Resources CIRNAC, Nunavut Regional Office

Date: December 6, 2019

Re: **2AM-LUP1520 – Review of documentation from Lupin Mines Inc. (LMI) in response to commitments made at the technical meeting – Lupin Mine Property – Kitikmeot Region, Nunavut**

Applicant: Lupin Mines Inc. (LMI)
Project: Lupin Mine Project
Region: Kitikmeot

BACKGROUND

The Lupin Mine Site is situated in Nunavut's Kitikmeot region, approximately 250 km West of Arviat, 285 km southeast of Kugluktuk, Nunavut, and about 400 km north of Yellowknife, Northwest Territories. The airstrip serving this Site is at 65° 46'00" N and 111° 14'41" W. The Site is on the western shore of Contwoyto Lake, approximately 60 km south of the Arctic Circle.

The mine property is currently owned by Mandalay Resources with the licensee of the site being LMI. The Lupin Mine was in operation from 1982 to 2005 with temporary suspensions of activities between January 1998 and April 2000, and between August 2003 and March 2004. The site has remained in Care and Maintenance since 2005.

Currently LMI is actively closing their property as per their approved Interim Closure and Reclamation Plan (ICRP) under water licence 2AM-LUP1520. Part of the renewal application is the review of their Final Closure and Reclamation Plan (FCRP). CIRNAC reviewed the documentation associated with the renewal application for adequacy and validation of security requirements for the Lupin site.

CIRNAC retained ARCADIS to support these technical reviews. On March 6th, 2019 CIRNAC submitted a technical Memorandum outlining issues, concerns and Information requests needed in order to complete the review of the renewal application. LMI responded indicating that CIRNAC's issues, concerns and information requests will be addressed during the technical review stage. CIRNAC responded stating that we were satisfied with this approach with the anticipation that concerns and requested information would be provided at the technical review phase.

Many identified issues were resolved through the technical review phase and commitments were made by LMI at the technical meeting to provide documentation and information required to resolve the remaining issues. CIRNAC, supported by Arcadis, has reviewed the recent required documentation submitted by LMI and provides the following comments and recommendations.

Tailings management area (TMA) and Tailings containment area (TCA) are used interchangeably as different documents being reviewed used different terminology for the exact same area.

1. HUMAN HEALTH ECOLOGICAL RISK ASSESSMENT (HHERA)

Issue: Required HHERA was not provided prior to the technical meeting.

Commitment: HHERA would be provided on or before October 15, 2019.

Comment: The objectives of the HHERA report were to evaluate the potential risks to human health and the environment from the contamination associated with the historical operation of the Site as a gold mine in order to derive site-specific target levels (SSTLs) for any potential risks identified, and to use the SSTLs to define areas requiring remediation and/or risk management. The HHERA will also confirm that the measures outlined in the Final Closure and Reclamation Plan (FCRP) are sufficiently protective of human health and the environment. This included the proposal to consolidate much of the waste rock in the mill and camp area in a 'dome' and to cap it with an infiltration reduction cover comprising a one meter thick layer of esker sand and gravel.

The geographical extent of the assessment was limited to the Site defined as the parcel of land occupied by the mine and mill site only, and associated roads and water supply facilities at Contwoyto Lake; it is noted that the Tailings Containment Area (TCA) that could be subject to Acid Rock Drainage (ARD) was not part of the assessment. Risks resulting from historical operations were evaluated based on current environmental conditions (soil, groundwater, surface seepage).

Predictions from surface water quality modelling of receiving water bodies (i.e., Boot Lake, East Lake and Lower Sewage Lake) evaluated the performance of the proposed granular esker cover of the waste rock dome to assess risks associated with ARD-seepage from the covered dome based on expected conditions. The surface water quality model incorporated hydrologic inputs based on thermal-seepage modelling. The predictions in the water quality model were based on changes in contaminants of concern (COC) seepage loads resulting from changing runoff/infiltration conditions, and did not consider geochemical processes within the waste rock pile during infiltration that could also contribute to COC loads in the waste rock seepage.

Risks were evaluated within the risk assessment framework endorsed by federal and provincial regulatory agencies and followed sound methodology. The assessment included relevant COC, exposure pathways and receptors including ecological species at risk.

Risks to human health and ecological receptors were identified from several COC's in soil, plants and groundwater under current conditions. Exceedances of SSTLs were noted in areas where waste rock will be removed or covered, and the remediation and risk management measures outlined in the FCRP were considered sufficient to address these risks.

Moderate risks to aquatic life from low pH were identified for Boot Lake and East Lake under predicted future lake conditions, suggesting that proposed measures in the FCRP to manage waste rock may not be sufficient. Risks to aquatic life were also identified from cadmium, cobalt and copper in Boot Lake, East Lake and Lower Sewage Lake under predicted future conditions but were classified as negligible based on the conservatism build into the water quality model. However, water quality monitoring of these lakes was recommended to assess current conditions and evaluate the conservatism of the water quality model in order to verify that these risks are negligible.

Conclusion: The HHERA meets the objectives or purpose of the assessment. However CIRNAC recommends the following for further discussions;

I. Updated monitoring plan, including duration and frequency, is required to ensure that the planned measures are adequate for the protection of the human health and the environment at closure and post-closure.
II. LMI should include the tailings containment area in the assessment or justify why it is not necessary.

2. SECURITY

Issue: Security to be updated and agreed upon by interested parties prior to Public Hearing.

Commitment: Updated security estimate would be provided in advance of Public Hearing.

Comment: The provided estimate has limited information to support the majority basis of costs.

I. Almost 40% of capital cost is "Contractor indirects". Mobilization is ~80% of Indirect Cost, and is based on a series of Lump Sum (LS) items with no backup. Out of the total security held (approximately $23.3 million) about 16.5million (~71%) is either LS or indirect costs with limited backup. Clarity is required from LMI to provide additional description of the basis of the estimate.

II. LMI proposed Final Closure Plan (CP) estimate does not include for rip -rap armouring of the outer slopes of the dams. This is inconsistent with the approved 2005 Tailings Management Area (TMA) Closure Plan works.
III. LMI latest estimate provides for $999,674 for TMA closure. Review of prior estimates shows LMI values of $3.9 (2014) and $2.1 (2017) million. The accepted Knight Piesold 2016 estimate was $4.9million for the TMA.

Effective review of the estimate cannot be completed in a meaningful manner until further descriptions are provided for the various line items.

Conclusion: CIRNAC recommends that LMI provide additional detail on the planned nature and extent of the work to be undertaken, as well further discussions may be warranted on the closure cost estimate to clarify and confirm the estimates.

Update on Security: CIRNAC has currently reviewed the documentation provided by LMI, however at this time CIRNAC has many questions for LMI and therefore has yet to produce an updated security cost estimate of its own.

For clarity CIRNAC is stating that it has not yet come to agreement on updated security closure cost and is requiring LMI to provide additional documentation as stated above and participate in further security discussions.

CIRNAC has also reviewed the security framework for the periodic release of security and will be providing LMI with our comments early next week.

3. HISTORICAL DATA

Issue: CIRNAC requested confirmation of the ARD potential of the tailings dams, roadways as well as other built structures, and for LMI to indicate whether, based on the historical information, the additional study on ARD geochemical and pathway modeling will or not be provided.

Commitment: LMI would go through records and provide historical data analysis regarding ARD potential of tailings dams and roadways, and so on.

Comment: Brief memo by STANTEC dated august 14, 2019 for LMI presented results of URS Corporation 2005 Acid Base Accounting (ABA) work on 10 samples which concluded ARD was not an issue. This is based on one sample being Acid Generating (AG), 5 samples Potentially Acid Generating (PAG), and 4 samples Non-Potentially Acid Generating (NPAG). The submitted memo also estimated waste rock in dams at 100,000m3 based on an air photo estimate of 0.5m thickness of waste rock on TCA dams.

CIRNAC had requested reviews of the construction history to assess how much waste rock (which is now known to be much more acid generating than earlier predicted) was used in the construction of the dams, and then determine if additional characterization work would be beneficial.

LMI has not provided adequate historical information on the actual quantities of waste rock used in the construction of the dams. Such information is available in Kinross' Closure Plan for the TMA, Holubec, Jan 2005. For example, page 19 notes that Dam 3D constructed in 1986 had a final height of 9.5m, and due to sloughing of the down-stream face and need for more capacity, a 10m waste rock buttress was placed along the downstream side. Based on a length of 550m, this single structure alone accounts for more than 55,000m3 of waste rock. On that basis it is likely that the Stantec estimate of waste rock volume in the tailings dams are on the low side.

Conclusion: CIRNAC recommends that LMI thoroughly review the historical data available (i.e. Kinross Closure plan for the TMA, Holubec Jan 2005) to be able to provide a more accurate account of the ARD potential at site given that waste rock was used and that the waste rock is now known to be much more acid generating then previously predicted.

4. ARD GEOCHEMICAL AND PATHWAY MODELLING

Issue: ARD geochemical and pathway modeling would be required depending on the results from #3 commitment above

Commitment: Based on the results of #3 above, if required ARD Potential (rock characterization, and potentially including geochemical and pathway analysis) to be conducted at the TCA dams.

Comment: Based on a Memo from Stantec dated august 14, 2019 addressing commitment #3, Stantec concluded that ARD geochemical and pathway modelling is not needed for waste rock at TCA area. CIRNAC notes that the Golder review and assessment of acid potential of waste rock, including URS2005 data set found that 68% of the waste rock can be considered potentially acid generating.
In terms of potential waste rock volumes at the TCA, in addition to the 0.5m depth of waste rock cover on the dams as assumed by Stantec, CIRNAC suggests that significantly more waste rock exists in the TCA/Tailings Management Area (TMA) based on review of the approved TMA closure plan which found that:

- waste rock was used to construct J Dam (~250m long, ~5m deep),
- a waste rock embankment was on the downstream side of 3D (10m w, 10+m h, 550m l)

Conclusion: CIRNAC disagrees that there is no need for an ARD Geochemical and pathway modeling for the waste rock at the TCA dams. Based on the CIRNAC comments on #3 and #4 above CIRNAC is requesting that further documentation and/or discussions be presented to support the claim that there is no need for any additional ARD geochemical and pathway modeling.

5. GEOTECHNICAL DETAILS

Issue: CIRNAC requested that LMI provide geotechnical analysis to provide confirmation of dam stability and erosion control

Commitment: Geotechnical details of engineered structures (e.g. which dams will the rip-rap material be taken from to change slope and which dams will be enhanced, cross sections and details) to ensure long term stability and erosion control.

Comment: The Stantec memo report, dated November 14, 2019 provides stability analysis of dams in existing conditions and stability analysis of re-sloped K and M dams. Results are consistent with earlier analysis from Holubec 2005. The analysis does not include an assessment of the structures in thawed conditions. Dam cross sections were provided in the stability analysis, but no dimensions or slope information was provided in these figures.

Note that in the approved 2005 TMA Closure Plan, Section 7.4, Lupin made a commitment to “a minimum factor of safety equal to or greater than 1.5 for long term stability of earth structures, such as the 3D,K,M,and N dams”. The 2005 closure plan assessed 2 scenarios (frozen dam, thawed dam with different Ground Water Level. Based on the results and consistent with 2005 commitments to ensure stability, Lupin committed to rip rap stabilizing structures at M and K dams and re-sloping the outer WR face of Dam 3D.

The LMI submission provided plan views for cell 4 and 5 surface water flow along with a cross-section detail for a typical outflow structure, but no details on how it would be located in place across the dams. No details were provided with respect to the shallow surface drainage feature on tailings covers (e.g. it is not clear whether is it a lined ditch of simply a graded sloped in the tailings cover.

Conclusion: CIRNAC recommends LMI provide more specific information on the location where embankment stabilization work would be carried out and design details (including final design cross sections showing existing and proposed conditions including construction materials). LMI should also provide reviews to confirm the location and extent of surface stabilization and erosion protection works.

CIRNAC recommends that LMI provide the missing details/information to better evaluate the stability of the dams at the tailings containment facility.

6. DOME DESIGN

Issue: CIRNAC requested more details on the design of the "dome" which will encapsulate materials remaining on site.

Commitment: Preliminary design level explanation of waste rock storage "Dome" design (including typical cross section, seepage, topography, geochemistry and storm water drainage estimates, etc.)

Comment: The memo by Golder, dated October 15, 2019 repeated what was presented in the technical meeting. It provided some information on consolidation of waste rock area (from 54.5 to 23.2ha) and provided conceptual comments on slopes (1.55% over most area, 10% from 1.4m depth waste rock to grade, conceptual drainage), but did not provide a typical design cross section through proposed dome, nor any design details/specification on proposed drainage systems, cover stabilization, etc.

This response provides little in the way of general engineering or specification of these features, and makes it difficult to assess and cost these features. The memo does not address any potential cover performance risks such as subsidence / consolidation issues that may occur in the crown pillar areas where open cuts will be filled or at the shaft which is now planned to be filled, not capped. How can LMI ensure that 1 m esker cover will not be affected by subsidence in these areas over time?

The Golder memo notes that current seepage have exceedances of Canadian Environmental Quality Guidelines (CEQG) criteria and estimates that the cover will reduce infiltration to about 23% of 2019 value and 36% of 2100 value.

CIRNAC would like to note that ICRP concept would have removed much of the waste rock to the tailings system and thus reduced impacted flows from the mill site dramatically. The current proposed plan for the waste rock to be consolidated in the "dome" and covered is of higher risk to the environment than what was proposed in the ICRP.

Conclusion: CIRNAC recommends provision of preliminary design cross sections and design details/specification on proposed drainage systems and cover stabilization of proposed dome, in order to provide the confidence that the covered "dome" is protective of the environment.

7. POSSIBLE DOME SEEPAGE

Issue: Seepage Quality and Loading from the “Dome”

Commitment: LMI to provide a geochemical source term and load model for seepage from the waste rock “Dome.”

Comment: Geochemical source term inputs were developed for natural runoff, cover runoff, waste rock seepage, and unreclaimed facilities (i.e., airport strip) using surface water quality, seepage water quality and short-term leach test results, including seepage data collected in August 2019. Source terms were calculated for expected conditions (50th percentile) and upset conditions (75th percentile). These geochemical source terms along with hydrologic inputs developed based on thermal-seepage modelling were used to predict receiving water quality (Boot Lake, East Lake, Lower Sewage Lake) to evaluate the performance of the proposed waste rock dome in reducing chemical loading to the environment.

Water quality modelling for the open-water season (June to September) was performed using PHREEQC and consisted of mixing contact water from cover runoff and waste rock seepage with natural runoff. As such, the model did not rely on mixing with a stored reservoir volume and no time-lag was included to account for progressive changes in water quality resulting from monthly loading differences. The model conservatively assumed that all runoff from each runoff type reached the prediction node (receiving water body) within each catchment area.

Variations noted in receiving water quality were attributable to whether precipitation and snow melt on top of the waste rock dome runs off (only interacting with cover materials) or infiltrates (primarily interacting with waste rock) producing seepage from the toe of the dome (runoff from natural ground or the airport strip was kept constant in the model).

The water quality model results indicated that seasonal effects (i.e., freezing) on the waste rock dome are a controlling factor on water quality. In June, all contact water occurs as runoff from the cover materials, producing the lowest predicted concentrations. Conversely, the greatest monthly concentrations of metals are predicted for August and September when all water seeps through the cover into the waste rock dome. Higher metal concentrations were generally predicted for East Lake and Lower Sewage Lake due to their relatively smaller watersheds compared to Boot Lake. Model results for expected conditions (50th percentile) indicated moderately acidic to neutral pH conditions in the receiving water bodies, ranging from 5.6 to 6.9. Environmental effects resulting from the predicted water quality under expected conditions (50th percentile) were assessed in the HHERA.

Under future climatic conditions (to the year 2100), the same range of metal concentrations was predicted in receiving waters but the number of months with 100% seepage increased from two (August and September under current climatic conditions) to four (July through October). The results of the thermal-seepage modelling (provided as a separate supporting technical memo to the HHERA) indicated that infiltration though the esker layer would increase over time when considerations of climate change are incorporated with an average increase of 4.95 degrees C in air temperature. In this case the esker would thaw earlier in the year and more precipitation would fall as rain, leading to an increase in percolation rates at the base of the esker from 16% to between 22% and 25%.

We note that changes to the waste rock seepage geochemical source term due to re-working of the waste rock in construction of the dome and increased interactions of infiltrating water with more waste rock and flushing of stored acidity within the pile are not considered in the water quality predictions. Golder on behalf of LMI indicated that additional static and kinetic geochemical laboratory tests are currently being conducted on waste rock samples that were collected in 2019, the results of which may help refine the geochemical source terms.

Conclusion: CIRNAC considers the documentation provided by LMI to be a seepage model rather than a source term model. However, CIRNAC is satisfied with the response with the condition that seepage samples are collected and modeling is updated periodically.

8. DECISION TREE/MATRIX

Issue: Possibility of exposed tailings in the dewatered pond portions of the tailings containment area after the water level has been lowered.

Commitment: Decision matrix/tree that determines how exposed tailings will be handled on a case by case basis when lowering the water level in the TCA.

Comment: In CIRNAC's view, the information provided in the Stantec memo, dated October 15, 2019 does not provide a "decision matrix" for how it would be decided as to whether or not, on a case by case basis in the field, exposed tailings would be left in place or removed and placed within the tailings cell.

Conclusion: It is CIRNAC's opinion that no material amount of tailings should remain outside of the defined containment cells at closure. Placement of 1m esker cover on any exposed tailings within the dewatered former pond areas, will not be effective in reducing ARD/ML from these tailings and result in impacted seepage from these areas. It is recommended that LMI provide an adaptive management decision matrix clearly outlining how the potentially exposed tailings would be managed.